ENDOCRINE SYSTEM WEBQUEST

Background:

The endocrine system is a complex network of glands, hormones and receptors. It provides the key communication and control link between the nervous system and bodily functions such as reproduction, immunity, metabolism and behavior.

In nearly all complex multicellular animals, there are two main systems controlling and coordinating the processes within the body:

- The nervous system, which exerts rapid point-to-point control by means of electrical signals passing down the nerves to particular organs or tissues.
- The endocrine system, which is a slower system based on chemical messengers, the hormones, which are secreted into the blood (or other extracellular fluids) and can reach all parts of the body.

The nervous system works in tandem with the endocrine system to control all bodily functions and processes.

Your mission: Become familiar with the endocrine system, how it relates to the nervous system and the result of this interaction on the body.

PART 1: The Glands and their Associated Hormones

Link: http://www.abpischools.org.uk/page/modules/hormones/index.cfm

1. Label the following 8 Endocrine glands

   ![Diagram of the endocrine system with glands labeled 1 to 8.]}
2. Now complete this table of all the hormones and their functions

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Function</th>
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</tbody>
</table>

3. **Test Yourself:** Study the chart above. Then try not to look at it and go to Drag and Drop Matching and complete the tutorial for the Endocrine System to test your memory!

   Link: [http://www.zerobio.com/drag_oa/endo.htm](http://www.zerobio.com/drag_oa/endo.htm)

**PART 2: Chemical Signaling Mechanisms**

4. Using the link below, complete the Venn Diagram below to compare Neural vs. Endocrine Signaling. Be sure you click the “play button” and read.

   Link: [http://sites.sinauer.com/neuroscience5e/animations07.01.html](http://sites.sinauer.com/neuroscience5e/animations07.01.html)

   Neural Signaling

   ![Venn Diagram](image-url)
5. Use the information in the link below to answer the following questions:
   
a. What is signal transduction?

b. What is the purpose of the body’s use of signal transduction?

c. What is unique about hormones that are used in the signaling process?

d. List three hormones and their functions.

e. The goal is for the signal sent from a gland to be transferred across the cell membrane. What problem arises in the process of transmitting this signal to the inside of a cell? What then acts to “transduce” the signal? (The word “transduce” means to convert)

f. What is meant by a signal cascade?

g. If a bear was chasing you, what gland would you hope was working properly? What is the function of epinephrine?

h. What important molecule is part of (attached to) a cAMP molecule? (hint: when running from a bear, your legs would not move without this molecule)

i. What is the purpose of kinases?

j. What is the result of the signal transduction cascade started by the enzyme kinase A?

k. What is the purpose of an inhibitor receptor?

l. What is signal transduction amplification?

PART 3: The Impact of Stress

6. Use the information in the link below to answer the following questions:
   Link: http://www.wisc-online.com/objects/index_tj.asp?objID=AP13804

   a. What main gland is involved with the stress response?

   b. What part of the nervous system does the hypothalamus interact with?

   c. Explain the physiological changes that occur when the hypothalamus stimulates the sympathetic nervous system. You can make a flowchart or a simple step process. Be sure to include ALL chemicals/hormones secreted, glands involved and the functions of each chemical/hormone.

   d. Why is physical exercise often suggested if you experience an abundance of stress?
PART 4: The Hypothalamic-Pituitary-Endocrine Axis and Positive and Negative Feedback Loops

7. Use the information in the following link to answer the questions below.
Link: http://highered.mcgraw-hill.com/sites/9834092339/student_view0/chapter46/positive_and_negative_feedback.html

   a. What is the difference between negative and positive feedback? Discuss them in terms of the changes in the process vs. the changes in the amount of the product. Hint: Read the text above the animation!

   b. In the animation, what hormone stimulates the release of GnHR and LH?

   c. Explain why the interaction between estrogen, GnHR and LH prior to ovulation is considered to be a positive feedback loop (effect)? Hint: review the definitions of positive feedback loops.

   d. After ovulation, what hormone is released in response to increased levels of LH?

   e. Explain why the interaction between progesterone, GnHR and LH after ovulation is considered a negative feedback loop (effect)? Hint: review the definitions of negative feedback loops.

8. Use the information in the following link to answer the questions below.
Link: http://bcswfreeman.com/thelifewire/content/chp42/4202s.swf

   a. Which gland is the link between the nervous system and the endocrine system?
b. When I think of the interplay between the hypothalamus and the pituitary gland, it reminds me of The Wizard of Oz in the scene below:

   i. Place the words hypothalamus and pituitary in the correct boxes below:

   ii. Why did you answer the way you did in the pictures above?

c. How is the pituitary gland like the substance below:

d. What two hormones are produced from the neurons that extend into the posterior pituitary?

e. What allows oxytocin and antidiuretic hormone (ADH) to be able to be released into the bloodstream?

f. Why is ADH known as a vasopressin (“vaso” = refers to blood vessel)?

g. What is contained in the anterior pituitary?

h. The hormones listed above are produced by the neurons in the posterior pituitary. How are hormones released from the cells in the anterior pituitary?
i. Complete the following table:

<table>
<thead>
<tr>
<th>Releasing Hormone</th>
<th>Tropic Hormone</th>
<th>Gland effected</th>
<th>Physiologic Response/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRH</td>
<td>FSH and LH</td>
<td>Thyroid</td>
<td>Release of estrogen in females and testosterone in males; gamete production; egg release and production of testosterone</td>
</tr>
<tr>
<td>Prolactin</td>
<td>Mammary glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GH</td>
<td>Throughout body</td>
<td></td>
<td>Release of cortisol to increase levels of glucose in the blood during times of stress</td>
</tr>
<tr>
<td>ACTH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSH</td>
<td>-</td>
<td></td>
<td>Release of melatonin in the dark (responds to seasonal changes)</td>
</tr>
</tbody>
</table>

j) Using the **Negative Feedback Loops** animation, answer the following questions:
   a. What chain reaction of hormones occurs to cause the adrenal cortex to secrete cortisol (as a result of a stress response)?
   b. What crucial physical connection exists that allows the production of cortisol to not continue out of control? Also, describe the process.

PART 5: The Role of Endocrinologist

Each of the scenarios below presents a different medical situation. With your knowledge of the endocrine system, identify the root cause of the medical condition.

1. A 15 year old boy who still displays all the physical characteristics of boys 4-5 years younger than him and has not begun to show any developmental changes indicating he is entering manhood.

   **Hormone(s):**

   **Gland where produced:**

2. Parents of a 5 year old girl are told by doctors that the reasons for the girl’s chronic illnesses are a weak immune system and low T-lymphocyte count.

   **Hormone(s):**

   **Gland where produced:**
3. A recently divorced middle-aged man who has also changed jobs and works long hours because he is stressed about receiving a promotion goes to the doctor because he has been gaining a lot of weight, especially in his abdominal region. The doctor notices that his face looks swollen and his blood-sugar levels are low. The doctor advises him to do some activities that will reduce stress and raise his metabolism in order to lose weight.

   *Hormone(s):*

   *Gland where produced:*

4. A patient comes into the ER complaining of a dizzy feeling. Doctors notice the patient has extremely low blood-sugar levels. Further testing reveals that the patient has a hypersecretion of ___ which is causing the problem so they prescribe and administer doses of the hormone ___ to counteract the body’s hypersecretion.

   *Hormone(s):*

   *Gland where produced:*

5. A woman in her mid-20’s has been having trouble falling asleep. Tests reveal that she has low levels of the hormone ___.

   *Hormone(s):*

   *Gland where produced:*

6. A woman brings her child into the doctor to determine the cause of the child’s small stature and extremely slow growth rate. There is no hereditary history of dwarfism in the family.

   *Hormone(s):*

   *Gland where produced:*